Incorporating "The Illuminating Engineer."

Light and Lighting

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Principal Contents:

Photometry Marches On

THIRTY Years Ago, when the Illuminating Engineering Society had just begun its work, there was much discussion about Standards of Light.

Paterson had just reported on the effect of barometric pressure, aqueous vapour and CO_2 on the candlepower of the Pentane Lamp, but already large bulb electric incandescent lamps, first prepared by Fleming in 1902, were becoming the accredited custodians of the "candle," soon to become by agreement the "international candle."

But scientists were still dissatisfied—continually harking back to the conception of a primary standard of light, based on the brightness of molten platinum under specified conditions, explored by Petavel in 1899 but proposed by Violle as early as 1879—nearly sixty years ago!

Little by little expectations in this direction have been realised. Only last year international agreement on a new "international candle," based once more on molten platinum and to come into operation in 1940, was attained.

In a second direction early dreams have come true. In 1908 light-sensitive cells and galvanometers were being tentatively explored as delicate, irresponsible and yet possibly useful adjuncts in the laboratory. To-day routine work is done generally, and in a fraction of the time formerly needed, by this very method. We have even attained, what would once have seemed miraculous, portable physical photometers registering light by the movement of a pointer.

National Physical Laboratory: Annual Visit—The Primary Standard of Light—The "Luminosity Curve"—Public Lighting in Leicester—Contrast Effects in the Operating Theatre—Cinema Lighting and Atmosphere—New Lamps for Glyndebourne Opera—Lighting Still the Chief Use of Electricity

National Physical Laboratory: Annual Visit

The annual visit to the National Physical Laboratory on June 28 revealed, as usual, how greatly the work of the Laboratory continues to extend and how varied are the functions which it now performs. We must, necessarily, confine ourselves to a very small portion of the general work, that dealing with photometry and illumination. There has come about during recent years almost a revolution in photometric methods, occasioned mainly by developments in photoelectric devices. The photoelectric spectrophotometer, for example, has superseded the visual instrument almost entirely for general purposes. Some of the work done in connection with illumination problems served as a basis for good popular demonstrations; for example, that relating to the effect of internal decoration on the lighting of rooms. Equally effective is the film enabling the perception of objects in the streets by light of different colours to be studied—which was demonstrated before the Illuminating Engineering Society some months ago.

Other interesting information is to be gleaned from the annual report for 1937. One is glad to notice that the records of daylight (enormously simplified by photoelectric methods) at Teddington and Manchester are now being extended to a district in a lower latitude and are being commenced at the University of Allahabad, India.

The Primary Standard of Light

Not the least useful of the work of the N.P.L. staff is that undertaken in connection with international committees, often involving great expenditure of time, tact, and tenacity! By this means has come about agreement on a most important point—which strangely has almost escaped general notice—the initiation of the new international candle, based upon what is in effect a primary standard of light (one-sixtieth of the luminous intensity of one square centimetre of a black body maintained at the temperature of solidification of platinum (2,046° K.). Already the various national laboratories are preparing groups of lamps to be measured in terms of the new candle, which is to come into operation in 1940.

The "Luminosity Curve"

Another topic of international moment is the question raised by recent researches in Germany and elsewhere in regard to the validity of the accepted values for the "luminosity factor," and the series of figures expressing, for each wavelength of light, the ratio of luminous flux to the corresponding energy flux. Apparently it has recently been suggested that the maximum of the curve lies nearer 5,650° A. than the 5,550° A. hitherto assumed. Experiments at the N.P.L. support the accepted international data. One would expect that the discrepancy might have a physiological origin—that it might be associated with the Purkinje effect and the now familiar fact that the relative brightness of two patches of coloured light depends both on the order of intensity at which the comparison is made and the portion of the reina on which their images are received. Reduction in the field size of the photometer, however, did not apparently make any difference. Oddities in the behaviour of the eye towards coloured light do, however, exist, and new phenomena are continually being revealed—notice, for example, the discovery mentioned elsewhere in the Report that monochromatic light *changed colour* (the hue wavelength altering as much as 100° Angstrum units) according to the point of entry of the light into the human eye.

Public Lighting in Leicester

In Leicester, as in the case of Sheffield, on which we commented last month (July, 1938, p. 166), there has been further progress. The total candle-power provided now exceeds one and a half million. During the past year the number of electric lamps increased from 3,667 to 4,506, which with the 5,496 gas lamps makes a total of 10,002. It is noteworthy that the cost of public lighting diminished somewhat from 5.53d. to 5.27d. per £. Relighting schemes involving a total of 201 mercury discharge lamps, mounted 25 ft. high, have been put into operation with good results. New traffic islands, for which special background brightness was provided, have also been constructed. The work of the lighting department steadily increases year by year, and it is now called upon to undertake a considerable amount of work beyond that concerned with street lamps. As instances of such problems may be mentioned the lighting of footpaths, shelters, car parks, and public lavatories, the erection of traffic signs, and the giving of advice on the lighting of badminton courts.

Contrast Effects in the Operating Theatre

The lighting of an operating theatre in a hospital has long been regarded as one of the most exacting of problems. In addition to the provision of an illumination greater than that considered necessary for any other ordinary purpose, there are special technical problems to be met. The light should come from a source of extensive area so that the hands and tools of the operating surgeon give rise to only the softest of shadows. It is necessary to avoid any overhead equipment liable to harbour dust. One of the greatest difficulties is to create sufficient brightness *within* the exploratory cavities created during an operation. Mr. H. W. Alexander, F. B. Lee, and L. S. Ickis, in a recent paper read before the American Illuminating Engineering Society, found that the "range of visibility" (tested with a Luckiesh-Moss visibility meter) was as much as 1.2 to 20.0, almost the whole range of the meter; this suggested that up to 2,000 foot-candles should be available, and, in some cases, as much as 10,000 foot-candles expedient in major surgery. One obvious difficulty, however, which increased illumination cannot in itself overcome is that of reversed contrast in the wrong direction—the brightness of the highly illuminated area adjacent to the cavity being often very much greater than that obtainable in its interior. The "drapes" used in proximity to the wound in hospitals often had a co-efficient of reflection as high as 33 per cent. Dark blue and green drapes, with a reflection factor of only 6 to 8 per cent., are effective in diminishing this troublesome and excessive contrast.

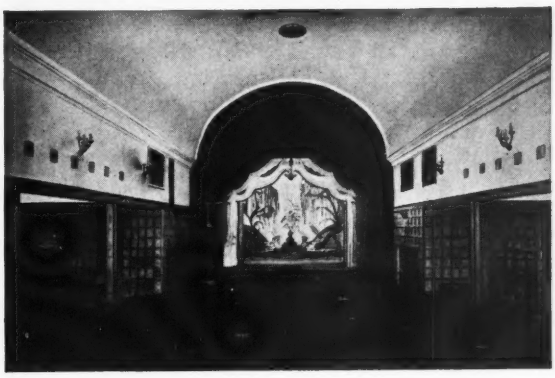
Cinema Lighting and Atmosphere

The question of providing moderate general diffused lighting in cinemas whilst films are in progress, to which the Illuminating Engineering Society has recently been devoting attention, is one that is being considered sympathetically by enterprising showmen. The objection to providing lights is not based entirely on the fear that the appearance of the picture might suffer—apprehension on this score could surely be allayed by demonstrations—but on the tradition of the theatre that the darkness keeps the audience *outside* the display and fosters the sense of illusion. Modern experts, however, do not all share this view; some hold that the aim should be to put the audience *inside* the field of influence so as to enhance the impression of reality. With this end in view they are contriving a mildly bright surrounds to screens, and carry this back towards the audience by appropriate illuminated scenery. There can be no question but that this procedure doubtless serves to alleviate any possible eye-strain involved in viewing a long film, besides helping to create the appropriate mental atmosphere. Psychology plays quite a part in the use of light in the modern cinema. We have heard of instances of gradations of brightness being used to guide the steps of visitors in the desired direction or to direct their eyes away from areas which it is not wished to emphasise. Our informant stated that it was not unusual, for the sake of some special effect, to project deliberately tinted light on to the screen—thereby weakening the contrasts more than any stray diffused light from the auditorium is likely to do. Loss of contrast, however, is often no drawback. It is quite possible with a film or lantern slides (revealed by transmitted light instead of by reflected light, as is the case with a picture or photograph, and, as a rule, in nature) to get contrasts that are actually excessive.

New Lamps for Glyndebourne Opera

Some members of the Illuminating Engineering Society will recall visiting the Glyndebourne Opera House, delightfully situated beside the country mansion of Ringmer, on the Sussex Downs, where Mozart operas are produced under almost ideal conditions. The Glyndebourne Opera Festival, now in its fifth season, continues to draw a fashionable audience from London—no small feat and one that emphasises the success of the methods of Mr. John Christie, who takes such a prominent part in the organisation of the festival.

An innovation in lighting has been introduced this year in the form of spot lanterns equipped with



A view, taken by artificial light, of the interior of the Glyndebourne Opera House, romantically situated on the slopes of the Sussex Downs.

2,000-watt Bi-Post lamps furnished by the G.E.C., ten of which light the stage from above, through apertures in the roof, and four others are installed on the first bridge directly over the proscenium. A feature of these lamps is the accurate positioning of the filament in relation to the cap, making possible exact control of the light in projectors. They have been installed in many film studios but this is believed to be the first time that they have been applied to the theatrical stage in this country.

Lighting Still the Chief Use for Electricity

The thirty-eighth Illumination Design Course recently held at the E.L.M.A. Lighting Service Bureau in London, the second of its kind arranged for electrical contractors, included a wide range of talks on light measurement, planning installations, the lighting of shops, schools, offices, and factories, etc.—a departure being Mr. Sawyer's discussion of the lighting of public houses and such incidental problems as the lighting of darts boards. Mr. W. J. Jones, in his introductory lecture, reminded his hearers that in 99 cases out of 100 lighting is still the chief use to which electricity is put. In spite of all the money spent by supply interests on the development of the cooking and heating loads lighting still supplies 50 per cent. of the total revenue. In view of this fact, it does seem strange that lighting figures so little in treatises on electricity. We have before us the 1938 edition of a standard textbook. Out of 500 pages *nine* are devoted to definitions of fundamental terms used in illumination and to photometry, and *six* to incandescent electric lamps and radiation. There is no mention of electric discharge lamps. No pages at all are devoted to applications of electric lighting.

Glassware in Relation to Decorative Lighting

In what follows we give a summary of the addresses delivered by Mr. Oliver P. Bernard and Dr. W. M. Hampton to the Decorative Lighting Section of the Illuminating Engineering Society on April 29th.

At the meeting of the Decorative Lighting Section of the Illuminating Engineering Society on April 29 there were two addresses by Mr. Oliver P. Bernard and Dr. W. M. Hampton, bearing on the above subject.

Early Impressions.

Mr. Bernard, who took for his title "The Value of Glass to Artificial Light," began by recalling some very early experiences—for instance, his pleasure when presented, on his eighth birthday, with a policeman's lantern, his impressions of the flashing colours on the glass prisms on the chandelier in the drawing room, and his observation of the globe—green outside, but lined with dazzling white that shaded his father's reading light.

It was, he suggested, not at all a bad idea to look at practical — even scientific — problems from a romantic point of view. A sense of romance is, in effect, a sense of gratitude, and gratitude requires intelligence. A more active sense of romance was needed in order to understand what might be done with glass, and to demonstrate its value to light. Recognition of this value involves an assessment of different notions of using glass. Glass was important to natural light long before it commenced to be useful to artificial light. This importance was originally protective, for windows existed without glass, and developed slowly, gradually becoming a progressive if not a dominant factor in building design.

A History of Windows.

A history of architecture for about 2,000 years might be written as a history of windows in the church, the manor house, the conservatory—until its apotheosis in the shop-front of the these days—days advertised as those of the Glass Age. The Crystal Palace was a most romantic conception of the value of glass, uninterrupted seeing and shelter combined. The Palace and the electric bulb alike demonstrated protective and optical principles of glass construction.

Optical principles excite more curiosity than protective principles, for the sense of seeing is the first and most instantaneous sense we possess. Mr. Bernard explained that he used the term "optical" in its visual sense. The term "ocular" might be applied to displays of light in public places such as those in Piccadilly and Trafalgar-square. Ocular is not always a good or well-employed characteristic of glass and artificial light, but it is extremely difficult to avoid. Optical adaptation of light engenders some sort of ocular effect, incidental or deliberately achieved and facilitated by the circumstantial values of glass—diffusion, distortion, concentration, projection, coloration, reflection, and refraction, obscuration and ornamentation. Confusion of circumstantial values often leads to poor design. Misunderstanding in regard to diffusion and obscuration, both in meaning and practice, is found. The price of diffusion is some loss of the original light. It is, at its best, an unfortunate necessity, a substitute for distribution.

Diffusion of Light

Glass is undoubedly the most convenient medium for diffusing, spreading, filtering, and diverting the source of illumination, but there is a tendency to expect too much of it. The sun and the earth form a useful demonstration of diffusive efficiency. Efforts to diffuse a 100-watt lamp in actual practice depend on the use of glass at a distance of a few inches from the source. Such practice commonly demands a glass which will obscure instead of merely diffuse. Many forms of glass are loosely regarded as diffusive, and more properly described as translucent. Translucent glass might be divided into two grades, which are decided by the maximum loss of light to be counted as diffusive, and which would be the minimum loss of light at which obscuration begins. Such standards of translucence would prevent some misuse of both glass and artificial light.

The Lighting of Public Buildings.

Mr. Bernard remarked that he knew of no place better for studying the practical and aesthetic relation of glass and light than the corridors of a good-sized public building, where sources are frequently too far apart and incidental glare, sometimes reduced by glass of high obscuration, is commonly in evidence. If one could make the corridor fit the light—or the light fit the corridor—adequately and consistently, without gaps or glare, the lighting of the rest of the building would probably be easy.

What is usually called general lighting is more usually wasted in certain directions. Unpleasing efficiency is not complete efficiency. One should be trying not to shape lighting units, but to shape light and the building together so that they function as one complete unit. One ought to think of the building as the actual fixture in which both daylight and artificial light have to take shape.

In conclusion, Mr. Bernard said that one could determine purpose and quality with reason, but there were no rules by which one could formulate aesthetics —in glass or any other material. Design is development—development of digested experience—and one cannot predict the result of that to which there is no end.

Shape, Colour, and Efficiency

Dr. W. M. Hampton, in the second address, explained that he did not propose to deal with decorative effect, but with influence of two main factors in decoration—shape and colour—on the efficiency of glassware as applied to lighting. Under "Colour" he included such characteristics as the use of clear or opal material.

One might first ask the question why glassware was necessary at all round lighting units, since it did, of necessity, absorb some of the light. The main reason, he suggested, was because present sources of light were in general too small and too bright to be looked at in comfort. The glassware diminished the brightness to a comfortable value, at the same time increasing the effective size of the source. In this connection he recalled the limit of five candles per square inch, specified for the brightness of opal glassware in the British Standard Specification No. 324—1934.

Assuming further that the function of the glassware was to redistribute the light in the required directions one might distinguish two forms of diffusion. One—*general*—where no attempt was made to control fundamentally the distribution, the glass merely serving to diminish the brightness of the source and to spread the light so that harsh

shadows were avoided; the other—*directional*—where light was taken from one direction and sent in another in order to increase the illumination in specified directions.

Varieties of Opal Glass

There was an almost unlimited variety of shapes for glassware made of opal glass. The glass itself might be through-coloured opal or flashed, or opal flashed on to a coloured base. In the case of hemispherical bowls it was a primary requirement of the glass that it should have a high reflection factor so that the direct light downwards was reduced considerably whilst the upward light, intended to be reflected from the ceiling, was increased. In fittings of this type the light was in general reflected only once at the surface of the opal, and the efficiency was, therefore, very high. In the case of totally or nearly totally enclosed fittings the light was transmitted by the opal before it escaped into the room, and the absorption of the opal glass might be all important. The light might be reflected many times inside the fitting before it emerged so that the absorption properties of the lamp-cap canopy, and so on, might have a marked effect on the efficiency of the complete unit. Few people (even including designers) appreciate the serious absorption of light that might be caused by a canopy having a low reflection factor.

Efficiency of Opal Globes

Dr. Hampton then referred to the formula given by Ryde and Cooper for the determination of the efficiency of globes of different neck sizes and with different sizes of canopies. Assuming an opal glass having a 50 per cent. reflection factor and a neck opening of 90 per cent. one could calculate the efficiency for varying values of the reflection factor of the canopy. It was shown that with reflection factors of 60-90 per cent. (white), 40 per cent. (grey), 0 per cent. (black), the corresponding light output ratios of globe and canopy were 0.82-0.91, 0.78 and 0.70. From the standpoint of the glass-maker it was annoying to find people grumbling about a 1 per cent. diminution in the overall efficiency of a complete sphere when they were quite prepared to use a canopy which, owing to the type of paint used with it, might diminish the light output ratio by 15 per cent.!

Prismatic and Other Glasses

Clear glass units were used exclusively for directional diffusion, which involved making the glass in various shapes that were either prismatic or lenticular. He doubted whether, in all cases, such units would be regarded as decorative, and where such precise redistribution of the light-flux was not needed it was possible to build up units of rolled or pressed glass, having patterns which were themselves attractive in appearance besides breaking up the direct light and distributing it approximately in the directions desired. Examples of such glass were reeded, broad-reeded, cross-reeded, luminating, dewdrop, stippolyte, glistere hammered, etc.—of which specimens were shown to the meeting.

Colour and Absorption

Next there was the question of colour. The ideal method would naturally be to use illuminants radiating in the particular parts of the spectrum selected. This aim was becoming nearer realisation owing to the development of gaseous discharge tubes of various types, but for some time to come most lighting installation would probably continue to make use of sources emitting an approximately white light and furnished with a colour filter. This of necessity would mean a reduction in efficiency, as even pale tints absorbed a considerable amount of light. Specimens of such filters of various tints (blue, green, pink, amber, etc.) were exhibited with the transmission factors, varying from 23 to 44 per cent., specified in each case. It was pointed out that although the tints were pale the amount of light absorbed was quite considerable. It was not always appreciated how absorption by a glass of given colour varied with a change in the light source. Any glass showing strong absorption in the red naturally showed increasing absorption as the colour temperature of the source was reduced.

Mechanical Strength and Thermal Durability

Mechanical strength and thermal durability were partly a function of the glass composition and partly of the shape of the article into which that glass was made. Differences in regard to tensile strength in different specimens of glass were relatively slight, but large differences in thermal endurance might occur. This quality was roughly inversely proportional to the coefficient of expansion. Quite large differences in this quantity might arise in glasses made in different factories. A more serious consideration was the effect of shape. Sharp corners and angles and abrupt changes in contour should be avoided, as they not only affected the strength directly but also, owing to the increased difficulties of manufacture, increased the risk of fracture.

There was no specific answer to the question, "What is the strength of glass?" The variation in strength between one specimen and another was a real property, and the question resolved itself into one of the probability of fracture under certain specific conditions. The most that the glass-maker could say was that the risk of breaking was less than one in so many, on the average, but he could not give a guarantee that no fracture would occur.

Finally there was the question of chemical durability. Certain glasses, fortunately usually those of low thermal endurance, were easily corroded by moisture, heat, and various fumes which might be found in factories. At the present time, however, most glasses were sufficiently satisfactory in this respect for no serious trouble to develop, although under tropical conditions the question did need serious consideration.

Floodlighting at the E.C.A. Conference

We illustrate above the floodlighting, during the period of the E.C.A. Conference, of the Queen's Hotel, Hastings, by means of B.T.-H. Mazdalux projectors. Most of the units were mounted on the existing street lighting columns, but others were on the flat roof of the new cocktail bar.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 483,877. "Luminescent Compositions."
Kutzelnigg, A. Dated March 11, 1936. *(Convention, Germany.)*

According to this specification a luminescent mass consists of a mixture of two or more metallic halides of stratified lattice structure, e.g., cadmium iodide, bromide or chloride, and manganese chloride or lead iodide.

No. 484,328. "Improvements in Combinations of Metal Vapour Electric Discharge Devices Adapted to Emit Radiation, and Electric Incandescent Lamps."
The General Electric Company, Ltd. (Communicated by Patent-Treuhand Gesellschaft für Elektrische Glühlampen m.b.H.) Dated December 18, 1936.

According to this specification a high mercury pressure vapour discharge lamp has a quartz or other envelope transparent to ultra violet radiation, and a filament surrounds this envelope, at least, partially. The filament and the envelope are enclosed in a sealed vessel, which is also of material transparent to ultra violet radiation and is frosted or matted.

No. 484,355. "Improvements in or Relating to Electric Incandescent Lamps."
N. V. Philips, Gloeilampenfabrieken. Dated April 15, 1936. *(Convention, Germany.)*

This specification covers an incandescent lamp of which the gas filling comprises krypton, argon, and nitrogen, in which the nitrogen content by volume is not greater than 25 per cent. and the krypton content is at least 60 per cent., but not more than 95 per cent. of the remainder. Zenon may be included as part of the krypton content. The major part of the advantages of a krypton filling are secured while the cost is reduced.

No. 484,566. "Improvements in and Relating to Electric Incandescent Lamps."
The British Thomson-Houston Company, Ltd. Davies, L. J., Warren, H. W. H., and Hamilton, G. Dated October 5, 1936.

This specification covers an incandescent electric lamp bulb having a filament mounted in an envelope containing gas or vapour at about atmospheric pressure, the volume of the envelope being very small, as compared with existing lamps. For example, the volume of an 80-watt lamp is about one to ten cubic centimetres. The small volume reduces the danger due to bursting and facilitates the quick increase of pressure at starting to the full operating pressure. Also in order to facilitate sealing the envelope is provided with a metal exhaust tube, the sides of which are pressed together and electrically welded to seal the lamp.

No. 484,633. "Improvements in Protective Devices for Electric Incandescent Lamps."
The General Electric Company, Ltd. (Communicated by Patent-Treuhand Gesellschaft für Elektrische Glühlampen m.b.H.) Dated May 10, 1937.

This specification relates to incandescent lamps filled with mercury vapour operating at a pressure of one atmosphere or greater, and, according to the invention, such a lamp is provided with a protective resistor of negligible or positive temperature/resistance co-efficient shunted by a resistor of large negative temperature/resistance co-efficient, both in series with the filament. The current is controlled by the first resistor until it is short circuited by heating of the second resistor. Preferably both resistors are within a sealed jacket enclosing the filament envelope.

No. 484,839. "Improvements in Electric Discharge Lamps."
The General Electric Company, Ltd. Boutell, J. N., and Jenkins, H. G. Dated February 16, 1937.

This specification describes the combination, as a light source, of a high-tension electric discharge device exciting to yellow white luminescence zinc silicate by means of a low-pressure mercury discharge and a high-tension discharge device producing the neon spectrum preferably in conjunction with other radiation derived from luminescent material excited by the neon discharge. The total luminous efficiency obtainable regularly from each component is arranged to be a maximum.

No. 484,975. "Improvements in or Relating to Electric Lamps."
N. V. Philips, Gloeilampenfabrieken. Dated November 20, 1936. *(Convention, Germany.)*

This specification describes a lamp comprising a gas discharge tube provided with thermionic electrodes heated by the discharge, an incandescent filament in series with this tube and constituting part of the current limiting impedance thereof, and a luminescent bulb enclosing the tube and the filament and constituting the wall of the space in which the filament glows. The discharge tube is preferably an ultra high-pressure mercury vapour tube.

No. 485,052. "Apparatus for Lighting from an Invisible Illuminating Source."
Todorowsky, V. Dated May 11, 1936. *(Convention, France.)*

This specification describes a light projector comprising two concave mirrors, one larger than the other, directed towards one another so that the smaller reflects light from a source between them unto the larger from which latter it is reflected externally. The large mirror has two foci, one of which is located centrally of the small mirror and coincident with the light source. The large mirror is covered by a screen having an opening receiving the small mirror and another opening in line with the second focus of the large mirror for permitting the egress of light without the source being visible from outside.

No. 485,325. "Improvements in Cathode Glow Lamps."
The General Electric Company, Ltd. (Communicated by Patent-Treuhand Gesellschaft für Elektrische Glühlampen m.b.H.) Dated April 15, 1937.

This specification relates to cathode glow lamps. In order to prevent blackening of the glass an open gauze offering little obstruction to the light and insulated from both cathode and anode is disposed between the cathode and the glass.

Public Lighting With Gas

The Herne Bay Urban District Council has extended its contract for gas lighting in the town until November 30, 1940.

A three-year agreement for street lighting by gas has been arranged between the Pickering (Yorks) U.D.C. and the local gas undertaking.

Among recent contracts specifying gas lighting are agreements affecting various parishes in Guernsey, South Hylton, near Sunderland, Largs, Berkhampstead (covering 336 lamps), Burham and Bridgewood, East Retford, Staveley, Aston, Ansterfield, and Beighton (Yorks).

About 1,030 lamps are covered by an agreement for street lighting by gas entered into by the Middleton Corporation recently. The Corporation has also decided to use gas for public lighting on three new housing estates.

The Borough of Wanstead and Woodford have installed thirty-four twelve-light gas lamps, thirty-two of which are on sixteen double-arm columns, to light a portion of Woodford-avenue, which is part of the Southend Arterial Road. The contract is for a period of five years.

A number of new ten-year contracts for gas lighting affect various villages in West Lothian. Among the authorities concerned are the Burgh of Whitburn and the West Lothian County Council, and the parishes include Blackburn, East Whitburn, and Stoneyburn.

Literature on Gas Lighting

To those interested in gas lighting we commend several recent issues of "A Thousand and One Uses of Gas" (issued by the British Commercial Gas Association), Nos. 280, 281, and 282 dealing respectively with Exterior Shop Lighting, Street Lighting, and Floodlighting by Gas. All are fully illustrated. No. 280 depicts some striking examples of parade lighting. Installations illustrated in No. 281 are drawn from all over the country, but include such familiar London examples as Whitehall, Aldwych and Kingsway, and Blackfriars-road, where the new "flat mantle" ("Supervia") lamps are in use. The floodlighting leaflet also covers a very wide ground; parks and gardens, churches, war memorials, and public buildings are all represented. Over 100 pictures have been assembled, however—a very representative collection.

Tulse Hill, Lambeth, a good example of high-pressure gas lighting.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from page 173, July, 1938.)

I.—RADIATION AND GENERAL PHYSICS.

200. Luminescence of Solids at Low Temperatures.
J. T. Randall. Nature, Vol. 142, No. 3,585, p. 113, July 16, 1938.

A number of solids which are not fluorescent at room temperatures are fluorescent at very low temperatures. A list of these is given. The low temperature spectra of a number of impurity phosphors activated by manganese differ from the room temperature spectra, the diffuse emission bands being narrowed. R. G. H.

II.—PHOTOMETRY.

201. A New Self-registering Photometer with Photocell.
G. Weber. Licht und Lampe, 7, pp. 145-147, July 10, 1938.

Describes an improved form of photometer, utilising a photoelectric cell, whereby polar curves of light-distribution are automatically traced out. The chief features of the present instrument, as compared with others previously described, consist in the methods of magnifying the galvanometer deflections and the incorporation of a compensation system ensuring accurate proportionality between illumination and deflection. Special measures to avoid alteration of the zero-point are also taken. J. S. D.

202. Fixation of a Scale of Colour Temperatures.
Hossein Djoudat. Rev. d'Opt., Vol. 16, No. 12, p. 401, December, 1937.

A series of incandescent lamps has been standardised in terms of colour temperature, the method of colour identity being employed. The reference black body used for the colorimetric comparisons comprised a furnace with a carbon heating element, the temperature of the body being measured with an optical hyrometer. Direct colour matching was employed, no filters on the black body side being required. R. G. H.

IV.—LIGHTING EQUIPMENT.

203. New Equipment and Appliances.
Anon. Elect., 121, p. 79, July 15, 1938.

Particulars with photographs are given of new lighting equipment, both for industrial and general purposes, now on the market. C. A. M.

204. The Glare Problem.
D. G. Sandeman. El. Rev., Vol. CXXIII., No. 3,163, p. 50, July 8, 1938

Gives a polar distribution for a street lantern which should give constant disability glare. This is shown to be similar to the distribution which gives constant brightness on a semi-polished road surface. An attempt is made to assess glare produced by reflections from the bonnet of an observer's car. R. G. H.

205. Engineering Aspects of Direct Lighting—Part I.—Louvred Systems.
J. M. Ketch and G. R. La Wall. Am. Illum. Eng. Soc. Trans., 6, pp. 545-565, June, 1938.

Useful data on the efficiency and distribution of reflectors equipped with louvres are given. The effects of reflector contour and finish, and of louvre design are discussed. J. S. S.

V.—APPLICATIONS OF LIGHT.

206. Light and Architecture.
Anon. Am. Illum. Eng. Soc. Trans., 6, pp. 517-522, June, 1938.

A number of representative architectural lighting schemes are described with photographs. J. S. S.

207. Lighting in the Hospital.
H. W. Alexander, F. B. Lee, and L. S. Ickis. Am. Illum. Eng. Soc. Trans., 6, pp. 523-544, June, 1938

A minimum illumination of 2,000 foot-candles for major operations is recommended as a result of measurements with the Luckeish visibility meter. Suggestions are also made for the lighting and decoration of the various sections of a hospital. J. S. S.

208. Drill Hall Lighting.
Anon. El. Rev., Vol. CXXIII., No. 3,164, p. 84, July 15, 1938.

Describes a fitting which comprises a system of lenses and mirrors which are adjustable for projecting light uniformly over an extended or a restricted area. The fitting has been used for the economical lighting of a large drill hall. R. G. H.

209. Blended Light for Merchandise Display.
Anon. El. Times, 93, p. 833, June 2, 1938.

Gives results of experiments in which high-pressure mercury vapour lamps and tungsten filament lamps are used in conjunction to give good colour rendering. The most economical arrangement was found to be one 80-watt high-pressure mercury-vapour lamp used with two 150-watt tungsten filament lamps. W. R. S.

210. The Art and Science of Street Lighting.
F. F. Middleton. El. Times, 93, pp. 865-866, June 9, 1938.

Deals briefly with some of the fundamental problems of street lighting, such as alterations in level, curvature, weather, etc., comparing cut-off and non-cut-off systems and different types of light sources. W. R. S.

211. Railway Stations.
"Pharos." Elect., 120, p. 813, June 24, 1938.

A discussion is given on the problem of the improvement of the appearance of railway stations at night. A recent installation at Malden Manor, on the Southern Railway, is illustrated as an example of one solution to the problem C. A. M.

212. Street Lighting with Electric Discharge Lamps on D.C.
Anon. World Power, 42, No. 12, p. 178, June, 1938.

Details, with photographs, are given of a large street lighting installation in London using electric discharge lamps on a Direct Current supply. C. A. M.

213. Lighting Made to Measure.
Anon. El. Times, 93, pp. 869-870, June 9, 1938.

Describes and illustrates some of the lighting effects obtained at the Glasgow Exhibition using reflectors of surface-treated aluminium and a range of special wattage lamps. Considerable savings in current consumption are claimed. W. R. S.

214. Empire Exhibition.
Anon. El. Times, 93, pp. 945, June 23, 1938.

Photographs and descriptions are given of floodlighting, including that for the Palaces of Engineering and Industry. W. R. S.

215. Australia's 150th Anniversary.
Anon. El. Times, 93, p. 893, June 16, 1938.

A collection of photographs with descriptions of some of the spectacular lighting effects used in the 150th anniversary celebrations. Colan floodlighting was widely employed. W. R. S.

216. Illuminated Gardens.
Anon. El. Times, 93, pp. 927-928, June 23, 1938.

Garden lighting is becoming increasingly popular, and in this article some of the best methods of achieving good results are described and illustrated. W. R. S.

217. Some Impressions of Illumination at the International Exposition, Paris, 1937.
A. L. Powell. Am. Illum. Eng. Soc. Trans., 6, pp. 567-587, June, 1938.

A general description of the lighting effects at the Paris Exhibition of 1937, with some technical data on the illuminated fountains. J. S. S.

A New System of Railway Platform Lighting

A view of the new Malden Manor Station on the Southern Railway, where Osira fluorescent discharge lighting has been installed.

A novel system of lighting has been employed for the platforms of the new stations at Malden Manor and Tolworth, on the Southern Railway. The construction of the roofing over the platforms is of arched form in reinforced concrete, thus avoiding the use of beams and stanchions which so often obstruct the platform illumination. This type of roofing lends itself admirably to the use of the new fluorescent discharge tubes, which have been mounted close to the roof in a line parallel with the platform edge.

Two forms of Osira tubing, one a neon tube corrected to give a warm pinky-white colour, the other utilising mercury vapour and corrected to give a pale blue green light, are mounted side by side. Eight 17-ft. lengths are used along each platform, and six transformers operating the tubing are concealed at the back of the platform above each of the canopies.

The colours produced by these two fluorescent tubes give a reasonable approach to daylight, and the general effect is excellent. The efficiency of the discharge tube lighting is considerably higher than that of ordinary tungsten filament lamps, and an illumination much exceeding that usually provided in suburban stations is secured without any appreciable increase in cost of current.

The best method of assessing the available illumination in such an installation perhaps requires some consideration. On the actual level of the platform values between 1½ and 2¼ foot-candles are provided, whilst 3-4 foot-candles are available three feet above platform level. The illumination is very evenly distributed, and the value on a vertical plane is also very substantial—as may be seen from the excellent appearance of the advertisements in the illustration above. The colour of the light is doubtless also an important consideration in showing up display advertisements.

We are indebted to the Lighting Department under Mr. George Ellison, Chief Engineer of the Southern Railway, and to the General Electric Company, Ltd., for the above information, and to the latter for the striking picture which appears above.

The main feature of the installation, which is imperfectly conveyed by figures for foot-candles, is the impression of *general brightness* which it conveys. We understand that in view of the success of these two trial installations the method is likely to be adopted for lighting other new stations now under construction.

Electric Street Lighting Progress

Accrington.—The lighting superintendent (Mr. J. C. Crabtree) estimates that the remaining 20 per cent. of the streets in the town will be provided with electric lighting by the end of the year.

Ashington, Northumberland.—The Council agreed to accept the tender of the North Eastern Electric Supply Company to provide new street lighting standards with time switches on the Alexandra-road and West End Housing schemes. The number of lamps involved is twenty-eight, the total cost amounting to £645. The chairman announced that electric lighting systems had that night been switched on for the first time at Sheepwash, Bothal and Woodhorn, three parishes which were recently added to the area, and previously without light.

Ayr.—To improve the lighting on Prestwick-road the Lighting Sub-Committee proposes to remove alternate standards and re-erect them on the opposite side of the road.

Barnet.—The Council has decided to improve the lighting of High-street from Bedford-avenue to Hadley Green, using 250-watt mercury discharge lamps at 120 ft. spacing. A contract is to be entered into with the North Metropolitan Electric Light Company on this basis.

Basford Rural District Council.—The Council proposes to introduce electric street lighting at Brinsley, Burton Joyce, Cossall, Kimberley, Linby, Bestwood and Ruddington. 452 lamps are involved. Nottingham Corporation Electricity Department will be responsible for Bestwood and Ruddington, and the Derby and Notts Electric Power Company for the remaining parishes. Proposals are to be considered by the parishes concerned.

Bethnal Green.—Mercury vapour lamps are to be installed on the south side of Hackney-road between Warner-place and Austin-street at a cost of £589. The Shoreditch Borough Council is to undertake the improvement of lighting on the north side of the same section of road.

Brierfield.—At an estimated cost of £400 the Urban District Council are providing centrally suspended sodium lamps throughout Burnley-road and Colne-road.

Fareham.—Seventeen discharge lamps at an estimated cost of £425 are to be used in the improvement of the lighting from High-street to Cams Hill. £170 of the cost will be borne by the Rate Fund. The Lighting Committee recommend that in future all lights in the Fareham Wards will be lighted from dusk to dawn all the year round. To extinguish a proportion of the lighting at midnight would be more expensive than the cost of electricity used during the period between midnight and dawn.

Midhurst, West Sussex.—The Council have accepted a tender on a five-year contract basis, for electric street lighting costing £1,356 2s. 6d.

Minehead.—After considering various proposals the Council have decided to accept a ten-year tender, at £909 per annum, for electric lighting.

Newcastle-under-Lyne.—The Highways Standing Sub-Committee has recommended the Council to apply for sanction to raise capital for street lighting improvements on the Trunk Road. Details of the proposals have been sent to the Ministry of Transport. Seventy-three electric lamps will be required, costing £2,042, together with a cable from Milehurst-lane to Yew Tree Bank at £2,690. The annual cost would amount to £730.

Preston.—Several important streets are to have modernised electric lighting at a cost of £4,000. The principal route included in the estimate is Blackpool-road from Garstang-road to the Cemetery.

Ramsey.—A five-year tender for electric lighting has been accepted.

St. Pancras.—At a cost of £176,489, St. Pancras Council agreed in principle to improve street lighting in the remaining streets in the Borough. The project covers 584 streets or places with a total route mileage of seventy-two. St Pancras lighting is mainly electric and electricity is used for all improvement schemes.

Selston, Nottingham.—The Council has decided to light the village by electricity on the expiration of existing contracts. The cost of the existing lamps amounts to £3 2s. 6d. each, and the electric lamps to £2 18s. 6d.

Thorne, Yorks.—At the annual Parish meeting the Council was authorised to expend £1,000 on street lighting. As the hire purchase of eighty-two electric standards had now been completed the Lighting Committee was able to undertake improvements to the extent of £95 per annum without increasing the rate. In addition, the lighting area would be extended while a certain number of lamps would burn all night.

Southport.—The Lighting Committee have instructed the Borough Electrical Engineer to instal eight electric (sodium) lighting standards (four all night and four half-night) at a cost for lighting, cleaning, extinguishing and replacements of globes of £51 3s. 2d. per annum. The Borough Electrical Engineer reported that he was preparing a scheme for the lighting of Park-road and Park-crescent. As an experiment six sodium lamps are to be erected in Scarisbrick New-road.

Wandsworth.—The Council has accepted a tender for the supply and delivery of 100 electrically illuminated refuge bollards at a cost of £790.

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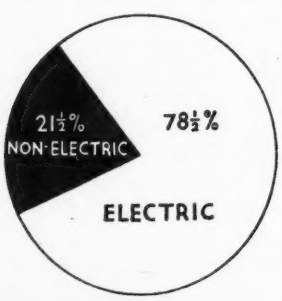
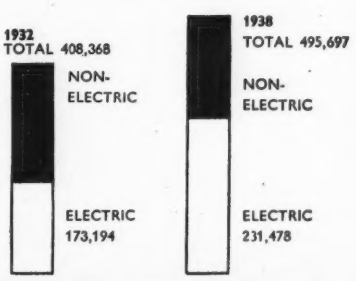
NEW STREET LIGHTING 1932-38 IN ALL TOWNS IN GREAT BRITAIN



During the past six years electricity has supplied nearly four-fifths of all new and improved street lighting

TOTAL STREET LIGHTING
a typical selection of 143 large towns in Great Britain



In 1932, there were 408,368 street lamps altogether, of which 173,194 were electric. In 1938, there were 495,697 altogether, of which 281,478 were electric, *i.e.*, the number of electric lamps had increased from 42.5% to 56.8% of the total; and the number of electric lamps shows an increase of over 60%

All those responsible for public lighting are invited to apply for a copy of "Electric Street Lighting" to the British Electrical Development Association Inc., 2 Savoy Hill, London, W.C.2

NOTES ON ILLUMINATING ENGINEERING ABROAD

(Specially Contributed—H. L. J.)

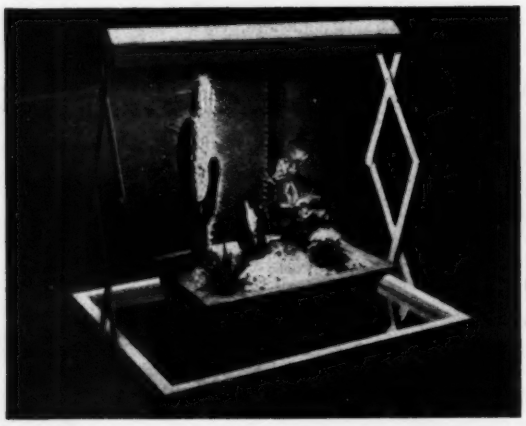
Switzerland.

Early this year the "Comite Suisse de l'Eclairage" published the first draft of the pending Swiss Lighting Code, entitled "Directives pour l'Eclairage Artificiel," an idea originated at the sixth session of the I.C.I. (1924), when all member nations were asked to develop recommendations for school and factory lighting. The code now issued includes three main sections, (1) Introductory, (2) Characteristics of Good Lighting, and (3) Lighting Arrangements. There are two appendices, the first classifying lighting conditions in different places and under different working conditions, the second devoted to definitions and the relations between photometric units, etc. The code is based on the "new candle," to be adopted in all countries by January 1, 1940, as recommended last year in Paris by the "Comite Consultatif de Photometrie." The first section deals in turn with illumination (minima and recommended values); shadow conditions; uniformity of light-distribution; stroboscopic effects and their prevention; glare; and colour of light sources (including combinations of electrical incandescent and discharge lamps). In the second section it is emphasised that a lighting system can only be called economic if it satisfactorily meets all conditions prevailing in the particular locality. The second section enumerates the different items requiring consideration and urges the need for co-operation with the lighting specialist at the earliest possible stage in the planning of buildings. In conclusion, maintenance problems and service conditions (e.g., daily burning hours for public lighting throughout the year, etc.) are discussed.

(*Bulletin of the Swiss Institution of Electrical Engineers.*)

France.

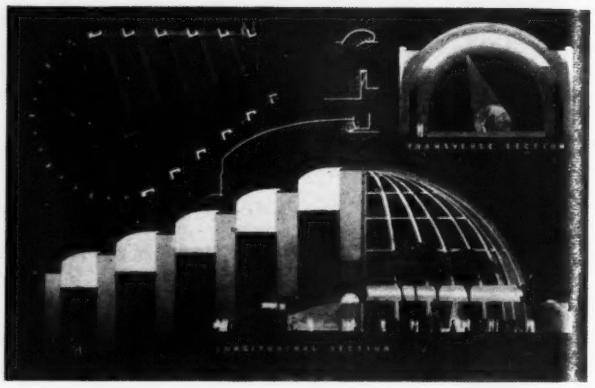
It is common knowledge that the appearance of flowers by night depends much on the light they receive. It ought to be possible in most cases (on a dining-room table, for instance) to secure better results by artificial light than are available by daylight. The accompanying sketch shows a device developed



in France for this purpose. A bowl of cacti is here shown, but baskets of flowers may be similarly treated. It is, of course, essential to the success of the scheme that the source of light (a tubular lamp) should be completely screened from the eyes of those round the table. Flexible side-supports enable the height of the lamp to be adjusted.

United States.

The picture here illustrated is one of a number in the Transactions of the Illuminating Engineering Society (U.S.A.) representing competitive efforts of students for the prizes offered for the solution of the problem of lighting a theatre auditorium. A number



of prizes (value $300 and downwards) were competed for by 119 entrants, chiefly architectural students. The University of Illinois appears to have been signally successful in this contest, in which both architectural design and planning of the lighting system are involved.

Australia.

In co-operation with the E.L.M.A. Lighting Service Bureau and the municipal and private power undertakings, a stand was erected at the Sydney ERDA (Electrical and Radio) Exhibition. Its centre piece was "The Lady of Light," which consisted of a rostrum, placed in an alcove, supporting a full-size figure of a modern woman. The background was lit by numerous concealed coloured spotlights, which could be switched on and off by the passer-by. This proved most successful as an example of modern display lighting. Other features were devices enabling the public to choose for themselves adequate lighting for different purposes (30 f.-c. was selected by the majority as the most comfortable illumination value for reading). At the first general meeting of the Illuminating Engineering Society (N.S.W.) for the new session period on February 22, the Council reported on the reciprocal arrangement with the I.E.S., London, whereby visiting members from either Society would be recognised as honorary members of the respective society for the duration of their visit. It also reported on the society's proposals to the State Government regarding the introduction of uniform lighting, which are at present under consideration in the various Government Departments.

(*Australasian Engineer.*)

Germany.

Particulars of the results of the Leipzig Spring Fair this year are now available. For the first time a specification is given of the turnover of lighting fittings purchased by buyers from abroad. The goods are divided into three grades. Only 23 per cent. of all sales abroad were for best quality and 47 per cent. of medium quality. Great Britain was the third largest buyer with 12.8 per cent. of the total sold to European countries.

(*Licht und Lampe.*)

Safer Highways!

Of the many social problems facing Great Britain to-day, the problem of street safety is one of the most serious.
The present ratio of accidents to population must be tremendously reduced, and to do that, more and better highway illumination is essential.

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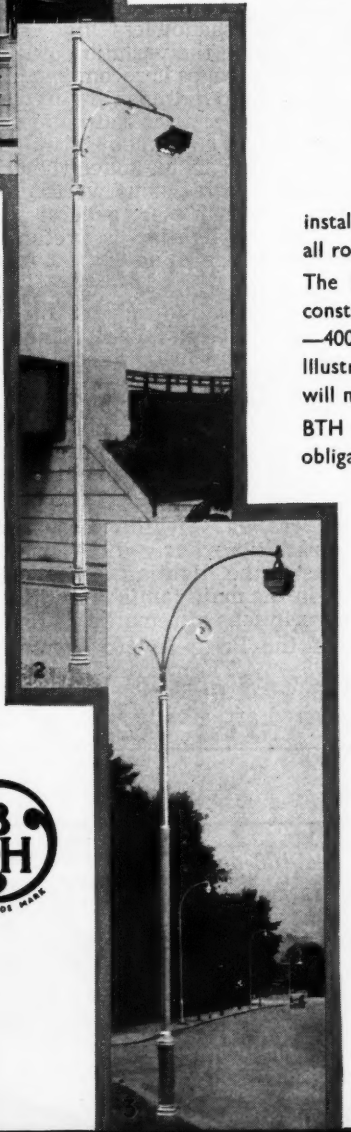
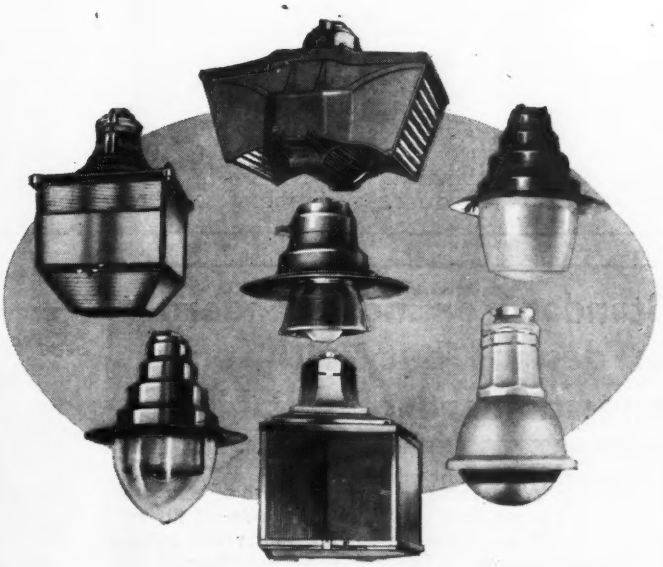


1. BTH DILEN Lantern in cradle bracket for island sites.

2. BTH MERCRA "H" Lantern on Standard column.

3. BTH DIRON Lantern on Shepherd's Crook column.



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We are reminded by Mr. Justus Eck, who has done so much useful and disinterested work on behalf of the E.I.B.A., of its ever-extending philanthropic efforts and its need for a corresponding increase in support. We understand that during 1937 over £5,000 was expended in relief, a substantial increase upon 1936, and that in the present year claims for assistance again show an advance. All claims are studied with care, and there is no need to emphasise what such sympathetic help means to those who have fallen on bad times. We therefore commend this good cause to our readers—more especially those directly associated with the electrical industry. Full particulars of the work of the E.I.B.A. and methods of contribution may be obtained from The Secretary, 6, Southampton-street, Holborn, London, W.C.1.

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The Illuminating Engineering Society (U.S.A.)

Notes on the Current Transactions June, 1938

NEWS: *The I.E.S. Convention this year* will take place at Minneapolis from August 29 to September 1. Improvements in the *lighting of rural roadways* are to be actively studied. It is estimated that at least 10,000 miles will require lighting in the near future, at a cost approaching $50,000,000. *Route No.* 16, *from Lansing to Detroit, Michigan* (eighty-five miles), has been equipped with a reflector system at a cost of $25,000,000. It is equipped on both sides with reflector units placed 125 ft. apart. Each unit consists of three discs, each appr. 1½ in. dia., of synthetic resin, placed one above the other. The reflectors are actuated by car headlamps and intended to indicate the alignment of the road to drivers.

From July 1 the activities of the *Bureau for Street Traffic Research* are to be carried on at Yale University. Fifteen graduate fellowships are offered, each carrying a stipend of $1,200 p.a. including fees.

SUBJECTS OF PAPERS: *Lighting in the Hospital*, by H. W. Alexander, F. B. Lee, and Lynns Ickis, junr. Analyses lighting problems in hospitals, which involve (1) adequate and comfortable lighting for the patients' needs, (2) excellent visibility for the staff, and (3) a combination of these two in cases where seeing is required for staff in the presence of patients. In the clinical examination room 30-50 ft.-c. are recommended, in general produced by indirect lighting equipment with a fractional addition of direct lighting. In the surgery 500-1,500 ft.-c. or over, of almost shadowless light, are required. Equipment allowing the variation of illumination intensity at various stages is recommended. To relieve high contrast, coloured drapes are used. U.S. Government specifications restrict the increase of temperature, due to lighting equipment installed, to less than 5° in the area about 25 in. above the operating field, after one hour of continuous working at 1,000 ft.-c. For patients' wards 5 ft.-c. general illumination is required. Indirect lighting is preferable, with the use of bed lamps furnishing 20 ft.-c. for reading purposes.

Engineering Aspects of Direct Lighting—Part I., by J. M. Ketch and G. R. Lawall. The results of tests are tabulated and the authors come to the conclusion that the concentric louver form rates the highest in efficiency, followed by the combined cup and ring construction (polished) and the plaid. Louvers added to reflectors reduce the light output in varying degrees, but do not alter the principal classification of the beam spread by the mere reflector.

Some Impressions of Illumination at the International Exhibition, Paris, 1937, by A. L. Powell. This discusses the lighting arrangements at the Exhibition, in the main familiar in this country, with detailed descriptions of remarkable features.

Report of the Prize Award Committee *on Competition*, 1938—*"A Theatre Auditorium."* The winner was A. S. Pawlan, University of Illinois. The competition covered art, architecture, and lighting.

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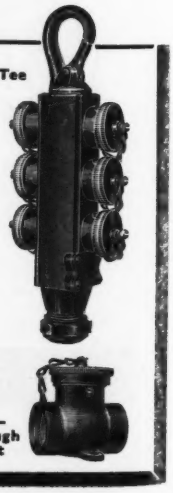

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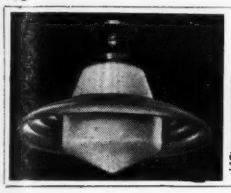
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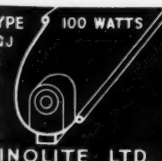

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"OVERLAMP" REFLECTORS
DISCHARGE OR GASFILLED LAMPS
SLIP-IT-ON SLIP-IT-OFF OVER THE LAMP FOR CLEANING
F.W. THORPE LTD. 39, BOLTON ROAD, SMALL HEATH, BIRMINGHAM.
FOR EASY MAINTENANCE - THE BEST

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SPECIALISTS IN THE TREATMENT OF CELLULOSE ACETATE FOR SHADES, FITTINGS, FIXTURES, ETC

20TH CENTURY ELECTRICAL
89-90 NEWMAN STREET, W.1.

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ULTRALUX AND LOUVERLUX FITTINGS *See them at*
THE LIGHTING CENTRE LTD
TROUGHTON & YOUNG LTD · KNIGHTSBRIDGE · SW1

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WARDLE ENGINEERING Co., Ltd.
OLD TRAFFORD, MANCHESTER, 16.
STREET LIGHTING EQUIPMENT. FLOODLIGHT PROJECTORS
WORKSLITE REFLECTORS. WARDELYTE GLASSWARE
PRISMALUX DIRECTIONAL UNITS.

SITUATION VACANT.

Draughtsman-Artist required. Must have experience in preparation of detail drawings and perspective sketches of decorative and industrial lighting fittings and detailing of architectural metal work, etc. Apply by letter to A.C.E. Utilities, Ltd., 93, Park-lane, London, W.1.

Index to "Where to Buy"

N.B.—The numbers are those attached to individual entries in the Directory (See pp. 200-202).

Changes of Address, etc.

CROMPTON, PARKINSON, LTD., are taking larger premises at Blackfriars House, Parsonage, Manchester 3, owing to expansion in the business of the plant sales office. Telephone numbers remain the same (Blackfriars 6212-4). Lamp and cable departments will continue to operate from Northern House, Manchester.

THE GENERAL ELECTRIC COMPANY, LTD., announce the opening of a new sales depot at 72-74, Castle-street, Reading (Tel., Reading 3257-8). The depot will serve the whole of Berkshire and Oxfordshire and small parts of Surrey, Hampshire and Buckinghamshire. Mr. L. F. Mills has been appointed manager.

THE BENJAMIN ELECTRIC, LTD., remind us of the change in their telephone number to Tottenham 5252, which took effect from July 14 onwards.

Catalogues and Advertising Literature

CONCRETE UTILITIES, LTD.—Illustrated catalogue featuring concrete columns in use in many towns and cities, seaside resorts, etc.

CROMPTON, PARKINSON, LTD.—Programme of Garden Fête held at Chelmsford on July 9, to celebrate anniversary of R. E. Crompton and Co.

GENERAL ELECTRIC COMPANY, LTD.—New Accessories Catalogue containing nearly 150 pages and 500 illustrations.

RADIOVISOR PARENT, LTD.—Leaflet describing Lighting Control Unit for (Mark V—A.C.).

Contracts Closed

THE EDISON SWAN ELECTRIC COMPANY, LTD.: *Royal Mail Lines, Ltd., Dundee Corporation Electricity Department, H.M. Office of Works, The Air Ministry, The General Post Office, Great Western Railway, and the London and North Eastern Railway*, for the supply of Royal "Ediswan" lamps.

Revo Reflector Fittings

Two very serviceable types of Revo Reflector Fittings are being introduced, the "Saferlite," illustrated below, and the "Passalamp." The chief feature of the "Saferlite," which ensures a safe temperature for flexible leads, is the method of assembly. One simply pushes up and pulls down to release both reflector and lamp, and repeats the process after cleaning. The mechanism is safe and certain. There is no danger of anything falling, there is not a single nut or screw to manipulate, and there are no intricate parts to wear or need replacement. Accessible porcelain terminal blocks are provided in the head. Wiring is quick and easy with the reflector detached. An earthing terminal is furnished, and the skirted shockproof lampholders comply with Home Office requirements. These units are now available in a great variety of types, adapted for mercury and sodium lamps.

The "Passalamp" series is designed to enable the reflector skirts to be detached for cleaning over the lamp. The advantages are similar to those of the "Saferlite" unit, but this series of reflectors is at present confined to the dispersive types for 60-watt and 100-watt lamps and dispersive waterproof types for 100-watt to 500-watt lamps.

Revo "Saferlite" Reflector

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